



**Rules for the
Manufacture, Testing
and Certification of
Materials, July 2011**

Notice No. 1

Effective Date of Latest
Amendments:

See page 1

Issue date: May 2012

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RULES FOR THE MANUFACTURE, TESTING AND CERTIFICATION OF MATERIALS, *July 2011*

Notice No. 1

This Notice contains amendments within the following Sections of the *Rules for the Manufacture, Testing and Certification of Materials, July 2011*. The amendments are effective on the dates shown:

Chapter	Section	Effective date
1	4, 5, 6	1 July 2012
2	1	1 July 2012
3	1, 3	1 July 2012
3	9	Corrigendum
4	2	Corrigendum
5	1, 2, 3, 4	1 July 2012
5	4	Corrigendum
8	1	1 July 2012
11	1, 3, 4, 5, 7	1 July 2012
12	2	1 July 2012
12	4	Corrigendum
13	2, 4, 8	1 July 2012
14	2, 3, 5	1 July 2012

It will be noted that the amendments also include corrigenda, which are effective from the date of this Notice.

The *Rules for the Manufacture, Testing and Certification of Materials, July 2011* are to be read in conjunction with this Notice No. 1. The status of the Rules is now:

Rules for Materials
Notice No. 1

Effective date: July 2011
Effective date: 1 July 2011 & Corrigenda

Chapter 1

General Requirements

Effective date 1 July 2012

Section 4

General requirements for manufacture

4.1 General

4.1.1 The following definitions are applicable to these Rules:

Item: A single forging, casting, plate, tube or other rolled product as delivered.

Piece: The rolled product from a single slab or billet or from a single ingot if this is rolled directly into plates, strip, sections or bars.

Batch: A number of similar items or pieces presented as a group for acceptance testing.

Wide Flat: flat product of a width over 150 mm, up to and including 1250 mm and thickness generally over 4 mm. Edges are square cut, i.e., hot rolled on the four sides. Supplied in lengths, not coils.

Plate/Sheet: flat rolled product whereby the edges are allowed to deform freely. Supplied flat and generally in square or rectangular shapes with a width of 600 mm or over, but other shapes may also apply.

Section 5

Non-destructive examinations

5.4 Non-destructive examination procedures

5.4.2 The shipyard, fabricator or manufacturer may submit other Codes or Standards for consideration by LR, providing they meet the requirements of these Rules. Where no agreed acceptance standard is in place, the acceptance levels contained in the subsequent Chapters of these Rules are to apply.

5.4.3 In the event that proposed acceptance criteria are not considered to be equivalent to these Rules, the criteria may be submitted for special consideration.

5.5 Non-destructive examination reports

(Part only shown)

5.5.1 NDE reports are to include all information required to identify how the examination was executed and are to include the following information where appropriate:

- (j) Test results with a map or record of any defects reportable and/or reject indications, giving location, dimensions and defect nature of indications.

Section 6

References

6.1 General

Table 1.6.1 List of National and International Standards (Part only shown)

Rule reference	Standard
Chapter 2 – Testing Procedures for Metallic Materials	EN 10045-1: 1999 ASTM E23-07ae1
Chapter 3 – Rolled Steel Plates, Strip, Sections and Bars	ASTM A255-07 (e1)10
Chapter 5 – Steel Forgings	ASTM E112-96 (2004)e210
Chapter 9 – Copper Alloys	ASTM E272-99 (2004)10
Chapter 10 – Equipment for Mooring and Anchoring	ASTM E112-96 (2004)e210 ASTM A255-07 (e1)10
Chapter 14 – Plastics Materials	ISO 527-2: 1993/corr1:1994 ISO 178: 2004 2010 ISO 14125: 1998/amd1:2011 ISO 14130: 1997/corr1:2003 DIN EN 59 ASTM D2583-07 BS 2782-10 Method 1001: 1977 ISO 175: 1999 2010

Chapter 2

Testing Procedures for Metallic Materials

Effective date 1 July 2012

■ Section 1

General requirements for testing

1.2 Testing machines

1.2.3 Impact tests are to be carried out on Charpy V-notch machines calibrated to ISO 148, ~~EN 10045~~ or ASTM E23 dependent on the testing machine type. The testing machines are to be calibrated using either a direct or indirect method. Other National Standards equivalent to ISO 148 may be considered.

Chapter 3

Rolled Steel Plates, Strip, Sections and Bars

Effective date 1 July 2012

■ Section 1

General requirements

1.5 Dimensional tolerances

1.5.1 The tolerances on thickness of a given product are defined as:

- (a) Minus tolerance is the lower limit of the acceptable range below the nominal thickness.
- (b) Plus tolerance is the upper limit of the acceptable range above the nominal thickness.

Nominal thickness is defined by the purchaser at the time of enquiry and order.

1.5.2 The average thickness of a product or products is defined as the arithmetic mean of the measurements made in accordance with the requirements in 1.5.10.

~~1.5.1~~ 1.5.3 For materials of nominal thickness 5 mm and more intended for hull structural purposes as detailed in Sections 2, 3 and 10, the under thickness tolerance of plates, strip and wide flats is not to exceed 0,3 mm. the minus tolerance on thickness of plates, strip and wide flats is 0,3 mm, irrespective of nominal thickness. For wide flats, this applies only where the width is greater than or equal to 600 mm. The average thickness of a product or products is not to be less than the nominal thickness. For thickness below 5 mm, the thickness tolerances are to be specially agreed.

1.5.4 Class C of ISO 7452 may be applied in lieu of 1.5.3. Where this standard is applied, both the requirements in 1.5.11 and the portion of the footnote of Table B.2 in ISO 7542, that reads; 'Also a minus side of thickness of 0,3 mm is permitted', are not applicable. Additionally, if ISO 7452 is applied, the steel mill is to ensure that the number of measurements and measurement distribution is appropriate to establish that the plates produced are greater than or equal to the specified nominal thickness.

~~1.5.2~~ 1.5.5 The minus tolerance on bars and sections (except for wide flats with a width ≥ 600 mm) is to be in accordance with the requirements of a recognised National or International Standard.

~~1.5.3~~ The attention of Shipbuilders and Owners is to be drawn to the fact that when thickness gauging is carried out during the ship's life, estimation of the diminution of hull plating and structure will be based on the nominal thickness, this being the original approved thickness for the item of structure under consideration.

~~1.5.4~~ The under thickness tolerance acceptable for classification is to be considered as the lower limit of a range of thickness tolerance which could be found in the normal production of a conventional rolling mill manufacturing material, on average, to the nominal thickness.

~~1.5.5~~ 1.5.6 The Shipbuilder and Owner may agree in individual cases whether they wish to specify a more stringent under thickness minus tolerance than that given in ~~1.5.4~~ this Chapter.

Existing paragraphs 1.5.6 and 1.5.7 have been renumbered 1.5.7 and 1.5.8.

Chapter 3

~~1.5.8~~**1.5.9** For the materials detailed in Section 7, the ~~under thickness minus~~ tolerance of material intended for use in the construction of cargo tanks is not to exceed 0,3 mm. For other applications, no minus tolerance is permitted in the thickness of plates and strip.

Existing paragraph 1.5.9 has been renumbered 1.5.10.

~~1.5.10~~ The thickness of plates and strip is to be measured at random locations whose distance from a longitudinal edge is to be at least 10 mm. Local surface depressions resulting from imperfections and ground areas resulting from the elimination of defects may be disregarded provided that they are in accordance with the requirements of a recognised National or International Standard.

1.5.11 The average thickness and thickness tolerance is to be measured at locations of a product or products as defined below:

- (a) An automated method or manual method may be applied to the thickness measurements. The procedure and the records of measurements are to be made available to the Surveyor and copies provided on request.
- (b) At least two lines among Line 1, Line 2 or Line 3, as shown in Fig. 3.1.1, are to be selected for the thickness measurements and at least three points on each selected line as shown in Fig. 3.1.1 are to be selected for thickness measurement. If more than three points are taken on each line, then the number of points shall be equal on each line.
- (c) For automated methods, the measuring points at sides are to be located not less than 10 mm but not greater than 300 mm from the transverse or longitudinal edges of the product.
- (d) For manual methods, the measuring points at sides are to be located not less than 10 mm but not greater than 100 mm from the transverse or longitudinal edges of the product.
- (e) Additional measurements may be requested by the Surveyor.

1.5.12 Local surface depressions resulting from imperfections and ground areas resulting from the elimination of defects may be disregarded provided that they are in accordance with the requirements of a recognised National or International Standard.

~~1.5.11~~ **1.5.13** Tolerances relating to length, width, flatness and ~~over~~ plus thickness are to comply with a National or international Standard.

Existing paragraph 1.5.12 has been renumbered 1.5.14.

1.5.15 The Shipbuilder is responsible for the storage and maintenance of product(s) delivered with acceptable surface conditions.

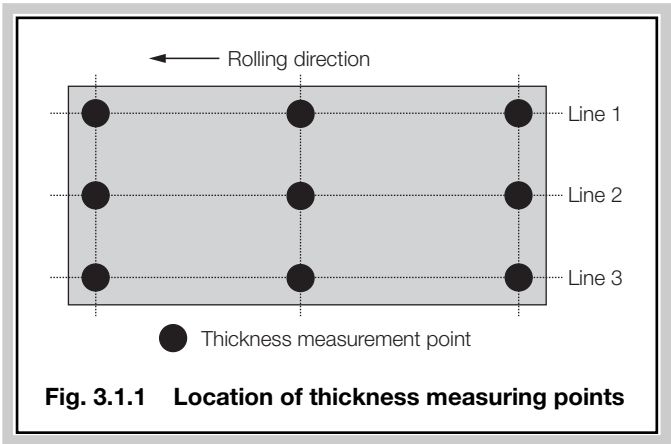


Fig. 3.1.1 Location of thickness measuring points

Existing Fig. 3.1.1 has been renumbered 3.1.2.

Section 3
Higher strength steels for ship and other structural applications

3.1 Scope

3.1.2 Provisions for material supplied in H47 strength grades are specifically intended for hatch coamings and deck structure of container ships.

Existing paragraphs 3.1.2 to 3.1.5 have been renumbered 3.1.3 to 3.1.6.

Table 3.3.1 Maximum thickness limits

Steel designation				Maximum thickness mm	
				Plates and wide flats	Sections and bars
AH 27S	DH 27S	EH 27S	FH27S	100 (see Note 1)	50
AH 32	DH 32	EH 32	FH32		
AH 36	DH 36	EH 36	FH36		
AH 40	DH 40	EH40	FH40		
AH 47 (see Note 2)	DH 47	EH 47	FH 47		Not applicable
NOTES					
1. Where the thickness exceeds 50 mm, the steel must initially be approved by way of a Nil Ductility Test, in accordance with ASTM E208, to show adequate crack arrest properties. The Nil Ductility Test Temperature is to be agreed for the thickness approved to ensure the crack arrest temperature is below the minimum design temperature. Where the thickness exceeds 70 mm and the material is used specifically as a crack arrest plate, the material must be specially approved with a crack arrest fracture toughness $K_{ca} \geq 6000 \text{ N/mm}^{1.5}$.					
2. Minimum thickness for H47 strength level is 50 mm, see 3.1.2.					

3.4 Chemical composition

3.4.1 The chemical compositions of ladle samples for all grades of steel are to comply with the requirements given in Table 3.3.2. The requirements for H47 strength grade steels are given in Table 3.3.3.

Table 3.3.3 Chemical composition for Grade AH 47, DH 47, EH 47 and FH 47

Chemical element	max. (%)
Carbon	0,20
Manganese	2,00
Silicon	0,55
Phosphorus	0,030
Sulphur	0,030
Nickel	2,00
Chromium	0,25
Molybdenum	0,080
Grain refining elements (see Note 1) Aluminium (acid soluble)	0,015 min. (see Note 2)
Residual elements Copper	0,35
NOTES 1. The grain refining elements niobium, vanadium and titanium are to be in accordance with the approved specification. 2. The total aluminium content may be determined instead of the acid soluble content. In these cases, the total aluminium content is to be not less than 0,020%.	

Existing Tables 3.3.3 to 3.3.6 have been renumbered 3.3.4 to 3.3.7.

Table 3.3.3 3.3.4 Carbon equivalent requirements for higher tensile strength steels up to 100 mm in thickness when supplied in the TM condition (Part only shown)

Grade				Carbon Equivalent, max. (%)	
				$t \leq 50$	$50 < t \leq 100$
AH 40	DH 40	EH 40	FH 40	0,40	0,42
AH 47	DH 47	EH 47	FH 47	Not applicable (see Table 3.3.1)	0,49

3.4.4 The cold cracking susceptibility, P_{cm} , is to have a maximum value of 0,22 per cent for steels of H47 strength grade.

Existing paragraphs 3.4.4 to 3.4.7 have been renumbered 3.4.5 to 3.4.8.

Chapter 3

Table 3.3.4 3.3.5 Conditions of supply for plates and wide flats (Part only shown)

Grade	Grain refining practice (see Note 1)	Thickness range mm	Conditions of supply (see Note 2)
AH 47 DH 47 EH 47 FH 47	Any practice	≤50 50 < t ≤ 100	Not applicable TM

3.6 Mechanical tests

3.6.7 For plates and wide flats in H47 strength grade, one set of impact tests is to be made on each piece.

Existing paragraphs 3.6.7 to 3.6.9 have been renumbered 3.6.8 to 3.6.10.

Table 3.3.6 3.3.7 Mechanical properties for acceptance purposes (see Note 1) (Part only shown)

Grades (see Note 3)	Yield Stress N/mm ² min.	Tensile Strength N/mm ²	Elongation on 5,65 $\sqrt{S_0}$ % min. (see Note 2)	Charpy V-notch impact tests (see Notes 3, 4 and 5)					
				Average energy J minimum					
				t ≤ 50 mm		50 < t ≤ 70 mm		70 < t ≤ 100 mm	
				Longitudinal	Transverse	Longitudinal	Transverse	Longitudinal	Transverse
AH 47 DH 47 EH 47 FH 47	460	570 – 720	17	—	—	53	35	64	42

NOTES

7. For steel of H47 strength grade, the yield to tensile strength ratio is not to exceed 0,94.

CORRIGENDUM

■ Section 9 Bars for welded chain cables

9.9 Non-destructive examination

(Part only shown)

Table 3.9.3 Dimensional tolerance of bar stock

Nominal diameter mm	Tolerance on diameter mm	Tolerance on roundness ($d_{\max} - d_{\min}$) mm
≤20	-0/+6,0 1,0	0,60

Chapter 4

Steel Castings

CORRIGENDUM

■ *Section 2*
Castings for ship and other structural applications

2.6 Acceptance levels for surface crack detection

Table 4.2.2 Acceptance criteria for surface inspection evaluation *(Part only shown)*

Quality level	Maximum number of indication	Type of indication	Maximum number each type	Maximum dimension of single indication, mm ² mm (see Note 2)

Chapter 5

Steel Forgings

Effective date 1 July 2012

■ *Section 1*
General requirements

1.8 Visual and non-destructive examination

1.8.7 Acceptance standards for defects found by visual or non destructive examinations are to be in accordance with any specific requirements of the approved plan, and with equivalence to any additional requirements of this Chapter. In all cases they are to be to the satisfaction of the Surveyor.

■ *Section 2*
Forgings for ship and other structural applications

2.5 Non-destructive examination

2.5.7 Ultrasonic testing is to be carried out in the zones ~~II to III~~ I to III as indicated in Fig. 5.2.2. Areas may be upgraded to a higher zone at the discretion of the Surveyors.

■ *Section 3*
Forgings for shafting and machinery

3.5 Non-destructive examination

(Part only shown)

3.5.1 Magnetic particle or dye penetrant testing (where appropriate) is to be carried out on forgings for main propulsion shafting (including propeller shafts, intermediate shafts, and thrust shafts with minimum diameter not less than 100 mm), on all connecting rod, ~~piston rod, and crosshead~~ forgings and on the following components when they are intended for engines having a bore diameter larger than 400 mm:

3.5.4 Ultrasonic testing is to be carried out in accordance with 2.5 on the following items:

- (a) Shafts having a finished diameter of 200 mm or larger when intended for main propulsion or other essential services.
- (b) All piston crowns and cylinder covers.
- (c) Piston rods, ~~and~~ connecting rods ~~and crossheads~~ for engines having a bore diameter greater than ~~200 mm~~ 400 mm.

Chapter 5

Table 5.3.4 Acceptance criteria for ultrasonic testing

Type of forging	Zone	Allowable disc shape according to Distance Gain Size (DGS), see Note 1, mm	Allowable length of indication, mm see Note 2	Allowable distance between two indications, see Note 2, mm
Propeller shaft Intermediate shaft	II	Outer $d \leq 2$ Inner $d \leq 4$	≤ 10 ≤ 15	≥ 20 ≥ 20
Thrust shaft Rudder stock	III	Outer $d \leq 3$ Inner $d \leq 6$	≤ 10 ≤ 15	≥ 20 ≥ 20
Connecting rod Piston rod ~~Crosshead~~	II	$d \leq 2$	≤ 10	≥ 20
	III	$d \leq 4$	≤ 10	≥ 20
NOTES 1. Outer part means the part beyond one third of the shaft radius from the centre. The inner part means the remaining core area. 2. For accumulations of two or more isolated indications which are subjected to registration, the minimum distance between two neighbouring indications is to be at least the length of the larger indication.				

CORRIGENDUM

■ Section 4 Forgings for crankshafts

4.5 Mechanical tests

Table 5.4.3 Mechanical properties for acceptance purposes: alloy steel forgings for crankshafts – Quenched and tempered

Tensile strength N/mm ²	Yield stress N/mm ² minimum	Elongation on $5,65\sqrt{S_0}$ % minimum		Hardness Brinell
		Long.	Tang.	
600–750	420	18	14	175–215
650–800	450	17	13	190–235
700–850	~~480~~ 480	16	12	205–245
750–900	530	15	11	215–260
800–950	590	14	10	235–275
850–1000	640	13	9	245–290
900–1100	690	13	9	260–320
950–1150	750	12	8	275–340
1000–1200	810	12	8	290–365
Intermediate values may be obtained by interpolation.				

Effective date 1 July 2012

4.6 Non-destructive examination

Table 5.4.5 Ultrasonic acceptance criteria for crankshafts (Part only shown)

Type of forging	Zone	Allowable disc shape according to Distance Gain Size (DGS), mm	Allowable length of indication, mm see Note	Allowable distance between two indications, see Note, mm
Crank shaft	I	$d \leq 2,0$	—	—
	II	$d \leq 3,0$	≤ 10	≥ 20
	III	$d \leq 4,0$	≤ 15	≥ 20

Chapter 8

Aluminium Alloys

Effective date 1 July 2012

Existing paragraphs 1.1.5 and 1.1.6 have been renumbered 1.1.6 and 1.1.7.

■ Section 1

Plates, bars and sections

1.1 Scope

1.1.3 The thickness of plates, sections and bars described by these requirements will be in the range between 3 and 50 mm. Plates and sections less than 3,0 mm thick may be manufactured and tested in accordance with the requirements of an acceptable national specification.

1.1.5 Where the section thickness exceeds 50 mm the requirements will be subject to special consideration.

1.8 Mechanical tests

1.8.3 The results of all tensile tests are to comply with the values given in ~~Table 8.1.4~~ Tables 8.1.3 and 8.1.4, as applicable.

Table 8.1.3 Minimum mechanical properties for acceptance purposes of selected rolled aluminium alloy products (Part only shown)

Alloy and temper condition	Thickness, t , mm	0,2% proof stress R_p , N/mm ²	Tensile strength R_m , N/mm ²	Elongation on 5,65 $\sqrt{S_0}$, 4d, %	Elongation on 5,65 $\sqrt{S_0}$, 5d, %
5083-O	$3 \leq t \leq 50$ (see Note 3)	125	275–350	16	14
5083-H111	$3 \leq t \leq 50$	125	275–350	16	14
5083-H112	$3 \leq t \leq 50$	125	275	12	10
5083-H116	$3 \leq t \leq 50$	215	305	12 (see Note 1)	10
5083-H321	$3 \leq t \leq 50$	215–295	305–380	12	10
5086-O	$3 \leq t \leq 50$	100	240–305	16	14
5086-H111	$3 \leq t \leq 50$	100	240–305	16	14
5086-H112	$3 \leq t \leq 12,5$ $12,5 < t \leq 50$	125 105	250 240	8 —	— 9
5086-H116	$3 \leq t \leq 50$	195	275	10 (see Note 2)	9
5059-O	$3 \leq t \leq 50$	160	330	24	24
5059-H111	$3 \leq t \leq 50$	160	330	24	24
5059-H116	$3 \leq t \leq 20$ $20 < t \leq 50$	270 260	370 360	10 10	10 10
5059-H321	$3 \leq t \leq 20$ $20 < t \leq 50$	270 260	370 360	10 10	10 10
5383-O	$3 \leq t \leq 50$	145	290	16 (see Note 1)	17
5383-H111	$3 \leq t \leq 50$	145	290	17	17
5383-H116	$3 \leq t \leq 50$	220	305	10	10

Table 8.1.4 Minimum mechanical properties for acceptance purposes of selected extruded aluminium alloy products (Part only shown)

Alloy and temper condition	Thickness, t , mm	0,2% proof stress R_p , N/mm ²	Tensile strength R_m , N/mm ²	Elongation on $5,65 \sqrt{S_0}$, 4d, %	Elongation on $5,65 \sqrt{S_0}$, 5d, %
5086-H112	$3 \leq t \leq 50$	95	240	12	10
5059-H112	$3 \leq t \leq 50$	200	330	10	10
5383-O	$3 \leq t \leq 50$	145	290	17	17
5383-H111	$3 \leq t \leq 50$	145	290	17	17
5383-H112	$3 \leq t \leq 50$	190	310	13	13

Chapter 11

Approval of Welding Consumables

Effective date 1 July 2012

Section 1

General

1.2 Grading

Table 11.1.1 Welding consumable grades appropriate to structural and low temperature service steel grades (Part only shown)

Consumable grade	Suitable for steel grades (see Notes)			
1. Ship Grade Steels (Ch 3,2 and Ch 3,3)				
2Y47	—	—	AH40	AH47
2Y47	—	—	DH40	DH47
3Y47	—	—	EH40	EH47
4Y47	—	—	FH40	FH47
2. Higher and High Strength Steels (Ch 3,3 and Ch 3,10) see Note 3				
NOTES				
1. Steel grades shown in bold italic type include the equivalent (LT-xxxx) low temperature service grades referenced in Ch 3,6.				
2. The Table applies to the multi-run welding techniques (i.e. m, S, M).				
3. Approval of consumables intended for welding high strength steels in Ch 3,10 also includes the standard ship steel grades as shown in bold italic type and equivalent low temperature service steel grades referenced in Ch 3,6.				

1.8 Certification

1.8.1 Each carton or package of approved electrodes consumables is to contain a certificate from the manufacturer, generally in accordance with the following: 'The <insert name of manufacturer> company certifies that the composition and quality of these electrodes consumables conform with those of the electrodes consumables used in making the test pieces submitted to and approved by the approval bodies nominated on the label of this package.'

Section 3

Electrodes for manual and gravity welding

3.1 General

3.1.6 Electrodes approved for strength levels between Y40 and up to and including Y50 Y40 to Y50, but excluding Y47 are also considered suitable for welding steels in two strength levels below that for which they have been approved.

3.1.7 Electrodes approved for strength levels Y47, Y55 and above are also considered suitable for welding steels in only one strength level below that for which they have been approved.

Table 11.3.1 Minimum low hydrogen approval requirements for manual and gravity electrodes

Approval grades	Low hydrogen grade required
1 (1N), 2 (2N), 3 (3N)	NR
2Y, 3Y, 4Y	H15 (see Note 2)
2Y40 to 5Y40	H15
3Y42 to 5Y42	H10
3Y46 to 5Y46	H10
3Y50 to 5Y50	H10
3Y55 to 5Y55	H5
3Y62 to 5Y62	H5
3Y69 to 5Y69	H5
1 1/2 Ni	H15
3 1/2 Ni	H15
5 Ni	NR (see Note 3)
9 Ni	NR (see Note 3)
NOTES 1. NR – Not required, but approval can be sought, if desired. 2. Optional in this case. If low hydrogen approval is not obtained, there is a limitation on the carbon equivalent of the steel which is permitted to be welded. 3. Assumes use of an austenitic, non-transformable, filler material.	

Table 11.3.1 Minimum low hydrogen approval requirements for manual and gravity electrodes

Approval grades	Low hydrogen grade required
1 (1N), 2 (2N), 3 (3N)	NR
2Y, 3Y, 4Y	H15 (see Note 2)
2Y40 to 5Y40	H15
2Y47 to 4Y47	H10
3Y42 to 5Y42	H10
3Y46 to 5Y46	H10
3Y50 to 5Y50	H10
3Y55 to 5Y55	H5
3Y62 to 5Y62	H5
3Y69 to 5Y69	H5
1 1/2 Ni	H15
3 1/2 Ni	H15
5 Ni	NR (see Note 3)
9 Ni	NR (see Note 3)
NOTES 1. NR – Not required. Approval may be obtained when requested. 2. Optional in this case. If low hydrogen approval is not obtained, there is a limitation on the carbon equivalent of the steel which is permitted to be welded. 3. Assumes use of an austenitic, non-transformable, filler material.	

3.2 Deposited metal test assemblies

3.2.2 For Y47 grades, as an alternative to Fig. 11.3.1, the thickness of the plate used for the test assembly may be taken as 50 mm.

Existing paragraphs 3.2.2 to 3.2.5 have been renumbered 3.2.3 to 3.2.6.

Table 11.3.2 Requirements for deposited metal tests (covered electrodes) (Part only shown)

Grade (see Note 3)	Yield stress N/mm ² minimum	Tensile strength N/mm ² (see Note 1)	Elongation on 50 mm % minimum	Charpy V-notch impact tests	
				Test temperature °C	Average energy (see Note 2) J minimum
1N, 2N, 3N	305	400 – 560	22	+20, 0, –20	47
1Y, 2Y, 3Y, 4Y	375	490 – 660	22	+20, 0, –20, –40	47
2Y40, 3Y40, 4Y40, 5Y40	400	510 – 690	22	0, –20, –40, –60	47
2Y47, 3Y47, 4Y47	460	570 – 720	19	0, –20, –40	53

3.3 Butt weld test assemblies

3.3.2 For Y47 grades, as an alternative to Fig. 11.3.2, the thickness of the plate used for the test assembly may be taken as 50 mm.

Existing paragraphs 3.3.2 to 3.3.12 have been renumbered 3.3.3 to 3.3.13.

Chapter 11

3.3.3 3.3.4 The grades of steel used for the preparation of the test assemblies are to be as follows:

Grade 1 (1N) electrodes	A
Grade 2 (2N) electrodes	A, B or D
Grade 3 (3N) electrodes	A, B, D or E
Grade 2Y electrodes	AH32, AH36, DH32 or DH36
Grade 3Y electrodes	AH32, AH36, DH32, DH36, EH32 or EH36
Grade 4Y electrodes	AH32 AH36, DH32, DH36, EH32, EH36, FH32 or FH36
Grade 2Y40 electrodes	AH40 or DH40
Grade 3Y40 electrodes	AH40, DH40 or EH40
Grade 4Y40 electrodes	AH40, DH40, EH40 or FH40
Grade 5Y40 electrodes	AH40, DH40, EH40 or FH40
Grade 2Y47 electrodes	AH47, DH47
Grade 3Y47 electrodes	AH47, DH47, EH47
Grade 4Y47 electrodes	AH47, DH47, EH47 or FH47

Where Grade 32 higher tensile steel is used, the tensile strength is to be not less than 490 N/mm². The chemical composition, including the content of grain refining elements, is to be reported in all cases where higher tensile steel is used.

3.5 Fillet weld test assemblies

3.5.2 For Y47 grades, as an alternative to Fig. 11.3.4, the thickness of the plate used for the test assembly may be taken as 50 mm.

Existing paragraphs 3.5.2 to 3.5.5 have been renumbered 3.5.3 to 3.5.6.

Table 11.3.3 Requirements for butt weld tests (covered electrodes) (Part only shown)

Grade (see Note 3)	Tensile strength N/mm ²	Bend test ratio: $\frac{D}{t}$	Charpy V-notch impact tests	
			Test temperature °C	Average energy (see Note 1) J minimum
				All positions (see Note 2)
1N, 2N, 3N	400	3	+20, 0, -20	47 (34)
1Y, 2Y, 3Y, 4Y	490	3	+20, 0, -20, -40	47 (34)
2Y40, 3Y40, 4Y40, 5Y40	510	3	0, -20, -40, -60	47 (39)
2Y47, 3Y47, 4Y47	570 - 720	4	0, -20, -40	53

Section 4

Wire-flux combinations for submerged-arc automatic welding

4.1 General

Table 11.4.1 Minimum low hydrogen approval requirements for wire-flux combinations

Approval grade	'H' grade for Multi-run	'H' grade for Two-run
1 (1N), 2 (2N), 3 (3N)	NR	NR
1Y, 2Y, 3Y, 4Y	NR	NR
2Y40 to 5Y40	H15	NR
3Y42 to 5Y42	H10	H15
3Y46 to 5Y46	H10	H15
3Y50 to 5Y50	H10	H10
3Y55 to 5Y55	H5	H10
3Y62 to 5Y62	H5	H5
3Y69 to 5Y69	H5	H5
1 ¹ / ₂ Ni	H15	NR
3 ¹ / ₂ Ni	H15	NR
5 Ni (see Note 2)	NR	NR
9 Ni (see Note 2)	NR	NR

NOTES

- NR – Not required, but approval can be sought, if desired.
- Assumes use of an austenitic, non-transformable, filler material.

Table 11.4.1 Minimum low hydrogen approval requirements for wire-flux combinations

Approval grade	'H' grade for Multi-run	'H' grade for Two-run
1 (1N), 2 (2N), 3 (3N)	NR	NR
1Y, 2Y, 3Y, 4Y	NR	NR
2Y40 to 5Y40	H15	NR
2Y47 to 4Y47	H10	H15
3Y42 to 5Y42	H10	H15
3Y46 to 5Y46	H10	H15
3Y50 to 5Y50	H10	H10
3Y55 to 5Y55	H5	H10
3Y62 to 5Y62	H5	H5
3Y69 to 5Y69	H5	H5
1 ¹ / ₂ Ni	H15	NR
3 ¹ / ₂ Ni	H15	NR
5 Ni (see Note 2)	NR	NR
9 Ni (see Note 2)	NR	NR

NOTES

- NR – Not required. Approval can be obtained when requested.
- Assumes use of an austenitic, non-transformable, filler material.

4.1.8 Wire-flux combinations approved with multi-run technique for strength levels ~~between Y40 and up to and including Y50~~ Y40 to Y50, but excluding Y47 are also considered suitable for welding steels in two strength levels below that for which they have been approved.

4.1.9 Wire-flux combinations approved with multi-run technique for strength levels Y47, Y55 and above are also considered suitable for welding steels in only one strength level below that for which they have been approved.

4.3 Deposited metal test assemblies (multi-run technique)

4.3.2 For Y47 grades, as an alternative to Fig. 11.4.1, the thickness of the plate used for the test assembly may be taken as 50 mm.

Existing paragraphs 4.3.2 to 4.3.8 have been renumbered 4.3.3 to 4.3.9.

Table 11.4.2 Requirements for deposited metal tests (wire-flux combinations) (Part only shown)

Grade	Yield stress N/mm ² minimum	Tensile strength N/mm ²	Elongation on 50 mm % minimum	Charpy V-notch impact tests	
				Test temperature °C	Average energy (see Note) J minimum
1N, 2N, 3N	305	400 – 560	22	+20, 0, –20	34
1Y, 2Y, 3Y, 4Y	375	490 – 660	22	+20, 0, –20, –40	34
2Y40, 3Y40, 4Y40, 5Y40	400	510 – 690	22	0, –20, –40, –60	39
2Y47, 3Y47, 4Y47	460	570 – 720	19	0, –20, –40	53

Chapter 11

Table 11.4.3 Requirements for butt weld tests (wire-flux combinations) (Part only shown)

Grade	Tensile strength N/mm ²	Bend test ratio: $\frac{D}{t}$	Charpy V-notch impact tests	
			Test temperature °C	Average energy (see Notes 1 and 2) J minimum
1N, 2N, 3N	400	3	+20, 0, -20	34
1Y, 2Y, 3Y, 4Y	490	3	+20, 0, -20, -40	34
2Y40, 3Y40, 4Y40, 5Y40	510	3	0, -20, -40, -60	39
2Y47, 3Y47, 4Y47	570 – 720	4	0, -20, -40	53

4.4 Butt weld test assemblies (multi-run technique)

4.4.2 The grade of steel used for the preparation of the test assembly are to be as follows:

Grade 1 wire-flux combination	A
Grade 2 wire-flux combinations	A, B or D
Grade 3 wire-flux combinations	A, B, D or E
Grade 1Y wire-flux combination	AH32 or AH36
Grade 2Y wire-flux combinations	AH32, AH36, DH32 or DH36
Grade 3Y wire-flux combinations	AH32, AH36, DH32, DH36, EH32 or EH36
Grade 4Y wire-flux combinations	AH32, AH36, DH32, DH36, EH32, EH36, FH32 or FH36
Grade 2Y40 wire-flux combination	AH40 or DH40
Grade 3Y40 wire-flux combinations	AH40, DH40 or EH40
Grade 4Y40 wire-flux combinations	AH40, DH40, EH40 or FH40
Grade 5Y40 wire-flux combinations	AH40, DH40 EH40, FH40

Grade 2Y47 wire-flux combinations	AH47 or DH47
Grade 3Y47 wire-flux combinations	AH47, DH47 or EH47
Grade 4Y47 wire-flux combinations	AH47, DH47, EH47 or FH47

Where Grade 32 higher tensile steel is used, the tensile strength is to be not less than 490 N/mm². The chemical composition, including the content of grain refining elements, is to be reported in all cases where higher tensile steel is used.

4.7 Annual tests

4.7.1 Annual tests are to consist of at least the following:

- For wire-flux combinations approved for the multi-run technique, one deposited metal test assembly.
- For wire-flux combinations approved for the two-run technique, one butt weld test assembly using plate material 20 to 25 mm in thickness. For Y47, the thickness of plate material may be taken as 50 mm.

Section 5

Wires and wire-gas combinations for manual, semi-automatic and automatic welding

5.1 General

Table 11.5.1 Minimum low hydrogen approval requirements for wires and wire-gas combinations

Approval grade	'H' grade for m and S techniques	'H' grade for M technique	'H' grade for T technique
1 (1N), 2 (2N), 3 (3N) 1Y, 2Y, 3Y, 4Y 2Y40 to 5Y40 3Y42 to 5Y42 3Y46 to 5Y46 3Y50 to 5Y50 3Y55 to 5Y55 3Y62 to 5Y62 3Y69 to 5Y69 1 ¹ / ₂ Ni 3 ¹ / ₂ Ni 5 Ni 9 Ni	NR H15 (see Note 2) H15 H10 H10 H10 H5 H5 H5 H5 H15 H15 NR (see Note 3) NR (see Note 3)	NR NR H15 H10 H10 H10 H5 H5 H5 H5 H15 H15 NR NR NR	NR NR NR H15 H15 H10 H10 H5 H5 H5 NR NR NR NR
NOTES 1. NR – Not required, but approval can be sought, if desired. 2. Optional in this case. If low hydrogen approval is not obtained, there is a limitation on the carbon equivalent of the steel which is permitted to be welded. 3. Assumes use of an austenitic, non-transformable, filler material.			

Table 11.5.1 Minimum low hydrogen approval requirements for wires and wire-gas combinations

Approval grade	'H' grade for m and S techniques	'H' grade for M technique	'H' grade for T technique
1 (1N), 2 (2N), 3 (3N) 1Y, 2Y, 3Y, 4Y 2Y40 to 5Y40 2Y47 to 4Y47	NR H15 (see Note 2) H15 H10	NR NR H15 H10	NR NR NR H10
3Y42 to 5Y42 3Y46 to 5Y46 3Y50 to 5Y50 3Y55 to 5Y55 3Y62 to 5Y62 3Y69 to 5Y69	H10 H10 H10 H5 H5 H5	H10 H10 H10 H5 H5 H5	H15 H15 H10 H10 H5 H5
1 ¹ / ₂ Ni 3 ¹ / ₂ Ni 5 Ni 9 Ni	H15 H15 NR (see Note 3) NR (see Note 3)	H15 H15 NR NR	NR NR NR NR
NOTES 1. NR – Not required. Approval may be obtained when requested. 2. Optional in this case. If low hydrogen approval is not obtained, there is a limitation on the carbon equivalent of the steel which is permitted to be welded. 3. Assumes use of an austenitic, non-transformable, filler material.			

5.1.14 Wires and wire-gas combinations approved with multi-run technique for strength levels between Y40 and up to and including Y50, but excluding Y47 are also considered suitable for welding steels in two strength levels below that for which they have been approved.

5.1.15 Wires and wire-gas combinations approved with multi-run technique for strength levels Y47, Y55 and above are also considered suitable for welding steels in only one strength level below that for which they have been approved.

Chapter 11

5.2 Approval tests for manual and semi-automatic multi-run welding

5.2.3 For Y47 grades, as an alternative to Figs. 11.3.1 to 11.3.4, the thickness of the plate used for the test assembly may be taken as 50 mm.

Existing paragraphs 5.2.3 to 5.2.11 have been renumbered 5.2.4 to 5.2.12.

5.3 Approval tests for multi-run automatic welding

5.3.3 For Y47 grades, as an alternative to Figs. 11.4.1 and 11.4.2, the thickness of the plate used for the test assembly may be taken as 50 mm.

Existing paragraphs 5.3.3 to 5.3.6 have been renumbered 5.3.4 to 5.3.7.

Section 7 Consumables for use in one-side welding with temporary backing materials

7.1 General

7.1.9 Combinations approved with multi-run technique (m, S and M) for strength levels between Y40 and up to and including Y50 Y40 to Y50, but excluding Y47, are also considered suitable for welding steels in two strength levels below that for which they have been approved.

7.1.10 Combinations approved with multi-run technique (m, S and M) for strength levels Y47, Y55 and above are also considered suitable for welding steels in one strength level below that for which they have been approved.

7.2 Approval tests for manual (m), semi-automatic (S) and automatic multi-run (M) techniques

7.2.2 The thickness of test assembly is to be 50 mm for Y47 base material.

Existing paragraphs 7.2.2 to 7.2.7 have been renumbered 7.2.3 to 7.2.8.

7.3 Approval tests for high heat input automatic (A) techniques

7.3.2 For Y47 grade, the thicker assembly is to be prepared from the maximum thickness for which approval is required, and the thinner assembly is to be prepared from 50 mm thickness. Where approval is required for 50 mm thickness, only one assembly from that thickness is required.

Existing paragraph 7.3.2 has been renumbered 7.3.3.

~~7.3.3~~ 7.3.4 Test specimens as follows are to be prepared as shown in Fig. 11.7.1 and Figs. 11.7.2(a) and (b):

- One longitudinal tensile test specimen (from centre of weld).
- Two transverse tensile test specimens.
- Two bend test specimens.
- One macro-section.
- From assembly 20 to 25 mm thick, two sets of three impact test specimens positioned and notched in accordance with Fig. 11.7.2(a).
- From assembly 35 to 40 mm thick, three sets of three impact test specimens positioned and notched in accordance with Fig. 11.7.2(b).
- From assembly of thickness 50 mm or more, three sets of three impact test specimens positioned and notched in accordance with Fig. 11.7.2(b). The second set positioned in the mid-thickness of test assembly. The bend specimens are to be tested, one with the face in tension, the other with the root in tension.

Table 11.7.1 Minimum low hydrogen approval requirements for one-side welding with combinations including temporary backing material

Approval grades	'H' grade for m and S techniques	'H' grade for M technique	'H' grade for A technique
1 (1N), 2 (2N), 3 (3N)	NR	NR	NR
1Y, 2Y, 3Y, 4Y	H15 (see Note 2)	NR	NR
2Y40 to 5Y40	H15	H15	NR
3Y42 to 5Y42	H10	H10	H15
3Y46 to 5Y46	H10	H10	H15
3Y50 to 5Y50	H10	H10	H10
3Y55 to 5Y55	H5	H5	H10
3Y62 to 5Y62	H5	H5	H5
3Y69 to 5Y69	H5	H5	H5
1 ¹ / ₂ Ni	H15	H15	NR
3 ¹ / ₂ Ni	H15	H15	NR
5 Ni (see Note 3)	NR	NR	NR
9 Ni (see Note 3)	NR	NR	NR
NOTES 1. NR – Not required, but approval can be sought, if desired. 2. Optional in this case. If low hydrogen approval is not obtained, there is a limitation on the carbon equivalent of the steel which is permitted to be welded. 3. Assumes the use of an austenitic, non-transformable, filler material.			

Table 11.7.1 Minimum low hydrogen approval requirements for one-side welding with combinations including temporary backing material

Approval grades	'H' grade for m and S techniques	'H' grade for M technique	'H' grade for A technique
1 (1N), 2 (2N), 3 (3N) 1Y, 2Y, 3Y, 4Y 2Y40 to 5Y40 2Y47 to 4Y47	NR H15 (see Note 2) H15 H10	NR NR H15 H10	NR NR NR H15
3Y42 to 5Y42 3Y46 to 5Y46 3Y50 to 5Y50 3Y55 to 5Y55 3Y62 to 5Y62 3Y69 to 5Y69	H10 H10 H10 H5 H5 H5	H10 H10 H10 H5 H5 H5	H15 H15 H10 H10 H5 H5
1 1/2 Ni 3 1/2 Ni 5 Ni (see Note 3) 9 Ni (see Note 3)	H15 H15 NR NR	H15 H15 NR NR	NR NR NR NR

NOTES

1. NR – Not required. Approval may be obtained when requested.
2. Optional in this case. If low hydrogen approval is not obtained, there is a limitation on the carbon equivalent of the steel which is permitted to be welded.
3. Assumes the use of an austenitic, non-transformable, filler material.

Existing paragraphs 7.3.4 to 7.3.7 have been renumbered
7.3.5 to 7.3.8.

Chapter 12

Welding Qualifications

Effective date 1 July 2012

■ Section 2

Welding Procedure Qualification

Tests for Steels

2.12 Mechanical test acceptance criteria for steels

(Part only shown)

2.12.4 Impact toughness tests:

- (a) Impact test specimens for hull construction are to be tested at the temperature, and are to achieve the minimum impact energy, as specified in ~~Table 12.2.2~~ **Tables 12.2.2 and 12.2.3.**

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Table 12.2.2 Impact test requirements for butt joints ($t \leq 50$ mm) see Notes 1 and 2

Grade of steel	Test temperature (°C) see Note 4	Value of minimum energy absorbed (J), see Note 4		
		Manual or semi-automatic welded joints		Automatically welded joints
		Downhand, Horizontal, Overhead	Vertical upward, Vertical downward	
A, see Note 3 B, see Note 3, D E A32, A36 D32, D36 E32, E36 F32, F36	20 0 -20 20 0 -20 -40	47	34	34
A40 D40 E40 F40	20 0 -20 -40		39	39
≥ 40	As specified for parent material	As specified in Ch 11, 4.3		

NOTES

- For thickness above 50 mm, impact test requirements are to be specially agreed. Steel with yield strength greater than 390 N/mm² is not permitted in thickness less than 50 mm, see Table 3.3.1 in Chapter 3.
- These requirements are to apply to test piece of which butt weld is perpendicular to the rolling direction of the plates.
- For grade A and B steels average absorbed energy on fusion line and in heat affected zone is to be a minimum of 27 J.
- For Naval ships both the test temperature and value of minimum energy absorbed are to be those specified for the parent material.

Table 12.2.3 Impact test requirements for butt joints ($t > 50$ mm), see Note 1

Grade of steel	Test temperature (°C) see Note 2	Value of absorbed energy (J, min.), see Note 2		
		Manual or semi-automatic welded joints		Automatically welded joints
		Downhand, Horizontal, Overhead	Vertical upward, Vertical downward	
A B D E	20 0 0 -20	34 34 47 47	34 34 38 38	34 34 38 38
AH32, AH36 DH32, DH36 EH32, EH36 FH32, FH36	20 0 -20 -40	47 47 47 47	41 41 41 41	41 41 41 41
AH40 DH40 EH40 FH40	20 0 -20 -40	50 50 50 50	46 46 46 46	46 46 46 46
AH47 DH47 EH47 FH47	20 0 -20 -40	53 53 53 53	53 53 53 53	53 53 53 53

NOTES

- These requirements are to apply to test piece of which butt weld is perpendicular to the rolling direction of the plates.
- For the Naval ships, both the test temperature and value of minimum absorbed energy are to be those specified for the parent material.

Existing Tables 12.2.3 to 12.2.5 have been renumbered
Tables 12.2.4 to 12.2.6.

2.15.8 Range of material types:

- (a) A qualification test performed on one strength level of steel may be used to weld all similar materials with the same or lower specified minimum yield stress with the exception of the two-run (T) or high welding heat input (A) techniques where acceptance is limited to the strength level used in the test. Similarly, a qualification test performed on a steel with one toughness level may be considered acceptable for welding all similar materials with the same or three toughness grades lower specified minimum toughness level.
- (b) A qualification test performed on H47 strength grade steels may be used to weld the steel of the same strength level or grade H40 and all lower toughness grades to that tested.
- (c) For high strength quenched and tempered steels, for each strength level, welding procedures are considered applicable to the same and lower toughness grades as that tested. For each toughness grade, welding procedures are considered applicable to the same and one lower strength level as that tested. The approval of quenched and tempered steels does not qualify thermo-mechanically rolled steels (TMCP steels) and vice versa.

- (d) For weldable C and C-Mn steel forgings, welding procedures are applicable to the same and lower strength level as that tested. The approval of quenched and tempered steel forgings does not qualify other delivery conditions and vice versa.
- (e) For weldable C and C-Mn steel castings, welding procedures are applicable to the same and lower strength level as that tested. The approval of quenched and tempered steel castings does not qualify other delivery conditions and vice versa. Dissimilar materials. Where a qualification test has been performed using dissimilar materials, acceptance is to be limited to the materials used in the test.

CORRIGENDUM

■ *Section 4*
Welding procedure tests for non-ferrous alloys

4.2 Requirements for copper alloys

Table 12.4.10 Range of approval for copper alloy material grades

Category	Alloy grade used in the qualification test	Alloy grades approved
Propellers	CU1 CU2 CU3 CU4	CU1 CU1 and CU2 CU1, CU2 and CU3 CU4 see Note 1
Tubes/pipes	90/10 Copper-Nickel-Iron 70/30 Copper-Nickel-Iron	90/10 Copper-Nickel-Iron 70/30 Copper-Nickel-Iron and 90/10 Copper-Nickel-Iron
~~Tubes~~ Tubes/pipes see Note 2	Copper-Phosphorus deoxidised – arsenical Copper-Phosphorus deoxidised – non arsenical Aluminium-brass	Copper-Phosphorus deoxidised – arsenical Copper-Phosphorus deoxidised – non arsenical Aluminium-brass
NOTES 1. Where a CU3 type welding consumable has been used for the qualification test, the range of approval may also include welding of CU3. 2. These grades have limited weldability and approval to weld is subject to the materials satisfying the requirements of Table 9.3.1 in Chapter 9.		

Chapter 13

Requirements for Welded Construction

Effective date 1 July 2012

■ Section 2

Specific requirements for ship hull structure and machinery

2.2 Welding consumables

2.2.2 Steel welding consumable approvals, up to and including Grade Y40, and Y47, are considered acceptable for hull construction in line with Table 11.1.1 in Chapter 11, Ch 12, 2.2.2 in ~~Chapter~~ Chapter 12 and the following:

- (a) Consumables up to Grade Y are acceptable for welding steels up to 3 strength levels below that for which the approval applies, e.g. a consumable with approval grading 3Y is acceptable for welding EH36, EH32 and EH27S higher tensile ship steels and grade E normal strength ship steel.
- (b) Consumables for Grade Y40 are acceptable for welding steels up to two strength levels below that for which the approval applies. Consumables for Grade Y47 are acceptable for welding steels up to one strength level below that for which the approval applies.
- (b)(c) Consumables with an approved impact toughness grading are acceptable for welding steels with lower specified impact properties subject to (a) above, e.g. a consumable with approval grading 3Y is acceptable for welding EH, DH and AH materials.
- (c)(d) For welding steels of different grades or different strength levels, the welding consumables may be of a type suitable for the lesser grade or strength being connected. The use of a higher grade of welding consumable may be required at discontinuities or other points of stress concentration.

2.12 Non-destructive examination of welds

2.12.6 The acceptance criteria for radiographic testing are given in Table 13.2.5, and those for ultrasonic testing in Table 13.2.6. ~~Alternative NDE acceptance criteria will be subject to special consideration provided that they are equivalent to these requirements.~~

■ Section 4

Specific requirements for fusion welded pressure vessels

4.15 NDE Method

4.15.1 Volumetric examinations may be made by radiography. For welds of nominal thickness greater than or equal to ~~10 mm~~ 8 mm, the examinations may be by ultrasonic testing. The preferred method for surface crack detection in ferrous metals is magnetic particle inspection. The preferred method for non-magnetic materials is liquid penetrant inspection.

■ Section 8

Specific requirements for welded aluminium

8.3 Fabrication and welding

8.3.2 A comparison of the mechanical properties for selected welded and unwelded alloys is given in Table 13.8.1.

Existing paragraphs 8.3.2 and 8.3.3 have been renumbered 8.3.3 and 8.3.4.

Table 13.8.1 Minimum mechanical properties for aluminium alloys

Alloy	Condition	0,2% proof stress, N/mm ²		Ultimate tensile strength, N/mm ²	
		Unwelded	Welded (see Note 4)	Unwelded	Welded (see Note 4)
5083	O/H111	125	125	275	275
5083	H112	125	125	275	275
5083	H116/H321	215	125	305	275
5383	O/H111	145	145	290	290
5383	H116/H321	220	145	305	290
5086	O/H111	100	95	240	240
5086	H112	125 (see Note 2)	95	250 (see Note 2)	240
5086	H116/H321	195	95	275	240
5059	O/H111	160	160	330	330
5059	H116/H321	260	160	360	300
5456	O	125	125	285	285
5456	H116	200 (see Note 5)	125	290 (see Note 5)	285
5456	H321	215 (see Note 5)	125	305 (see Note 5)	285
5754	O/H111	80	80	190	190
6005A (see Note 1)	T5/T6 Extruded: Open Profile Extruded: Closed Profile	215	100	260	160
		215	100	250	160
6061 (see Note 1)	T5/T6 Rolled Extruded: Open Profile Extruded: Closed Profile	240	125	290	160
		240	125	260	160
		205	125	245	160
6082	T5/T6 Rolled Extruded: Open Profile Extruded: Closed Profile	240	125	280	190
		260	125	310	190
		240	125	290	190

NOTES

1. These alloys are not normally acceptable for application in direct contact with sea-water.
2. See also Table 8.1.3 or Table 8.1.4 in Chapter 8.
3. The mechanical properties to be used to determine scantlings in other types and grades of aluminium alloy manufactured to National or proprietary Standards and specifications are to be individually agreed with LR, see also Ch 8,1.1.5.
4. Where detail structural analysis is carried out, 'unwelded' stress values may be used away from heat affected zones and weld lines, see also Pt 3, Ch 2,1.3.3 of the Rules for Ships.
5. For thickness less than 12,5 mm, the minimum unwelded 0,2% proof stress is to be taken as 230 N/mm² and the minimum tensile strength is to be taken as 315 N/mm².

Existing Tables 13.8.1 and 13.8.2 have been renumbered
Tables 13.8.2 and 13.8.3.

Chapter 14

Plastics Materials and other Non-Metallic Materials

Effective date 1 July 2012

■ **Section 2**
**Tests on polymers, resins,
 reinforcement and associated
 materials**

2.6 Reinforced thermosetting resins

2.6.4 The laminate is to be tested in accordance with procedures outlined in MQPS Book K procedure 14-1 and 2.4.4 in one fibre direction only.

2.11 Machinery chocking compounds (resin chocks)

2.11.2 Approval will be considered by LR for use under the following service conditions:

- Loading of ~~2,5~~ **3,5** N/mm² (max) for a temperature not exceeding 60°C.
- Loading of ~~3,5~~ **2,5** N/mm² (max) for a temperature not exceeding 80°C.
- Other loading conditions.

■ **Section 3**
Testing procedures

3.9 Machinery chocking compounds

Table 14.3.5 Tests for machinery chocking compounds (Part only shown)

Test	Standard
Barcol hardness	~~DIN EN 59~~ ASTM D2583-07 or BS 2782 part 10 Method 1001

■ **Section 5**
**Control of material quality for
 composite construction**

5.14 Synthetic chocking compounds

5.14.1 Table 14.5.8 gives the minimum property requirements for synthetic chocking compounds.

Existing sub-Section 5.14 has been renumbered 5.15.

Table 14.5.8 Minimum characteristics and mechanical properties of synthetic chocking compound

Properties	Minimum value
Izod impact resistance	0,8 J
Barcol hardness	40
Compression	100 MPa
Water absorption	0,05%
Oil absorption (light machine)	0,05%
Creep	< 0,2%

NOTES

1. Izod, barcol, compression, and water and oil absorption tests to be performed on samples cured/post-cured to the same condition as the samples for the final creep tests.
2. Minimum creep value to be attained for a stabilised sample after 1000 hours.

Section numbering in brackets reflects any Section renumbering necessitated by any of the Notices that update the current version of the Manufacture, Testing and Certification of Materials.

Chapter 3

1.7.4(a)	Fig. 3.1.1(a) <i>now reads</i> Fig. 3.1.2(a)
1.7.4(b)	Fig. 3.1.1(b) <i>now reads</i> Fig. 3.1.2(b)
1.7.4(b)	Fig. 3.1.1(c) <i>now reads</i> Fig. 3.1.2(c)
1.7.4(c)	Fig. 3.1.1(e) <i>now reads</i> Fig. 3.1.2(e)
1.7.4(d)	Fig. 3.1.1(f) <i>now reads</i> Fig. 3.1.2(f)
1.7.4(f)	Fig. 3.1.1(g) <i>now reads</i> Fig. 3.1.2(g)
3.8.1	<i>Reference 3.1.4 now reads 3.1.5</i>
3.4.2	Table 3.3.3 <i>now reads</i> Table 3.3.4
3.5.1	Table 3.3.4 <i>now reads</i> Table 3.3.5 Table 3.3.5 <i>now reads</i> Table 3.3.6
3.6.1	Table 3.3.6 <i>now reads</i> Table 3.3.7
3.6.8 (3.6.9)	Table 3.3.6 <i>now reads</i> Table 3.3.7
Table 3.3.6 (Table 3.3.7)	<i>Reference 3.6.8 now reads 3.6.9</i>

Chapter 10

4.6.8	Table 3.3.3 <i>now reads</i> Table 3.3.4
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Chapter 11

3.5.1	<i>Reference 3.3.3 now reads 3.3.4</i>
3.7.3	<i>Reference 3.3.12 now reads 3.3.13</i>
5.2.7 (5.2.8)	<i>Reference 5.2.6 now reads 5.2.7</i>
5.3.2	<i>Reference 4.3.3 now reads 4.3.4</i>
7.2.4	<i>Reference 3.3.12 now reads 3.3.13</i>
7.3.4	<i>Reference 3.3.12 now reads 3.3.13</i>
9.5.3	<i>Reference 3.5.3 now reads 3.5.4</i> <i>Reference 3.5.5 now reads 3.5.6</i>

Chapter 12

2.15.7	Table 12.2.3 <i>now reads</i> Table 12.2.4
2.15.9a	Table 12.2.4 <i>now reads</i> Table 12.2.5
2.15.9c	Table 12.2.4 <i>now reads</i> Table 12.2.5 (twice)
2.15.9e	Table 12.2.5 <i>now reads</i> Table 12.2.6

Chapter 13

8.4.1	Table 13.8.1 <i>now reads</i> Table 13.8.2
8.4.1	Table 13.8.2 <i>now reads</i> Table 13.8.3

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